

Modeling the Effective Emissivity of Rapid Thermal Processing Chambers for Radiation Temperature Measurement

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Accurate temperature measurement and control are critical for rapid thermal processing (RTP), a process that is becoming more and more important as the pattern features of microelectronics get smaller and smaller. A highly reflective cold plate has been implanted in the lower chamber of some industrial RTP systems to enhance the emissivity so that the temperature of the Si wafer can be accurately measured with optic fiber radiometers during the actual process. A better knowledge of the effective emissivity reduces the uncertainty in the temperature measurement. Diffuse-gray, diffuse-spectral, and specular models have been developed to predict the effective emissivity of RTP chambers based on the net-radiation method. These models are described in the present paper along with a parametric study on the influence of the geometric arrangement, surface properties, surface temperature, and wavelength. The effect of the radiometer opening hole is also investigated. The results will help improve radiation temperature measurement in RTP systems.

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